FORCE

OPTICAL BROADCAST SYSTEMS

Model 3020 RF Switch Module

Installation Guide and User Manual

I0M3020
Revision 5.0, April 2006

Technical Support

If you encounter any kind of problem after reading this manual, contact your local distributor or a Force, Inc. Applications Engineer. To reach technical support:

On the Web:	http://www.forceinc.com
By Phone (Monday through Friday 8:00 am to 5:00 pm EST):	USA (800) 732-5252 TEL (540) 382-0462
By Fax:	(540) 381-0392
By Email:	csr-sales@forceinc.com

825 Park Street, Christiansburg, VA 24073 • USA (800) 732-5252• TEL (540) 382-0462 • FAX (540) 381-0392 • csr-sales@forceinc.com • www.forceinc.com

© 2006 by Force, Inc. Force reserves the right to make changes to the product described in this document in the interest of product improvement.

Contents

Technical Support 1

Product Specifications 3

L-Band 50 Ohm Characteristics 3
L-Band 75 Ohm Characteristics 3
IF 50 or 75 Ohm Characteristics 4
Electrical Characteristics (See Note 5) 4
Physical Characteristics 4
Environmental Characteristics 4
Specification Notes 4

Installation and Operation 5

General Installation Instructions 5
Rear Panel Description 5
Figure 1 Model 3020 RF Switch Rear Panel 5
Module Front Panel Description 6
Figure 2 Model 3020 RF Switch Module Front Panel 6
3RU Chassis Description 6
3RU Power Supply Description 6
Items Provided 7
Items Required 7
Inspection 7
General Module Installation 7
Front Panel Controls 7
Rear Panel Connections 8
LED Functions 8
Safety Precautions 8
Operation Overview 8
Figure 3 Model 3020 RF Switch Block Diagram 8
RF Level Primary Trip Point 9
Figure 4 Test Point Voltage vs. RF Input Level 9
Modes of Operation 10
Figure 5 Model 3020 RF Switch State Diagram 10
SNMP Capabilities 11
Table 1 Monitoring Capabilities for the Model 3020 11
Table 2 RF Switch Specific Monitoring Capabilities for the Model 3020 11
Table 3 Control Capabilities of the Model 3020 RF Switch 11
Summary Fault Alarms 11
Table 4 Summary Fault Alarms 11
Initial Power-up 12
Cleaning 12
Troubleshooting 12
Problems and Comments 12

Warranty and Return Policy 13

Warranty 13
Force Obligations 13
Exclusions 13
Product Return Policy 14
Products Returned for Credit - Non Distributor 14
Products Returned for Repair or Replacement 14
Active Product Under Warranty 14
Obsolete Product Under Warranty 14
Active Out of Warranty 14
Obsolete Product Out of Warranty 15
Receiving an RMA for Returns 15
Shipping and Handling Precautions 15
Storing the Unit 15

Product Specifications

L-Band 50 Ohm Characteristics

	Min.	Typ.	Max.	Units	Notes
Frequency Range	950		2250	MHz	
RF Input Range	-50		+10	dBm	
RF Insertion Loss		3.5	4	dB	
Impedance		50		Ohm	1
IMD (-3 dB Input)			-65	dBc	
VSWR (Input/Output)		1.5:1	1.8:1		2
Group Delay (full band)			1.5	ns	
Isolation		55		dB	3
Threshold Set Range	-35		+10	dBm	4
Third Order Intercept Point	+32	+35		dBm	
Switching Speed (off-on)			100	μs	
Switching Speed (on-off)			50	μs	

L-Band 75 Ohm Characteristics

	Min.	Typ.	Max.	Units	Notes
Frequency Range	950		2250	MHz	
Flatness (full band)	-1.25		+1.25	dB	
RF Input Range	-50		+10	dBm	
RF Insertion Loss		4	5.0	dB	
Impedance		75		Ohm	1
IMD (-3 dB Input)			-65	dBc	
VSWR (Input/Output)		1.5:1	1.8:1		2
Group Delay (full band)			1.5	ns	
Isolation	38	45		dB	3
Threshold Set Range	-35		+10	dBm	4
Third Order Intercept Point	+32	+35		dBm	
Switching Speed (off-on)			100	μs	
Switching Speed (on-off)			50	μs	

IF 50 or 75 Ohm Characteristics

	Min.	Typ.	Max.	Units	Notes
Frequency Range	10		200	MHz	
Flatness (Full Band)	-0.5		+0.5	dB	
Return Loss	18			dB	
Group Delay (any 36 MHz)	-0.1		+0.1	ns	
VSWR	1.3:1				
Isolation		75		dB	

Electrical Characteristics (See Note 5)

	Min.	Typ.	Max.	Units	Notes
Power Supply Voltage		+20		V_{DC}	6
Supply Current		105		mA	
Power Dissipation		2		W	

Physical Characteristics

	Min.	Typ.	Max.	Units	Notes
Module Weight		1		lb.	
		.45		kg	
Module Dimensions		5.06 x 1.39 x 12.00		in.	
		129 x 35 x 305		mm	

Environmental Characteristics

	Min.	Typ.	Max.	Units	Notes
Operating Temperature Range	-10		+55	°C	
Storage Temperature Range	-40		+60	°C	
Humidity (RH, non-condensing)	5		95	%	

Specification Notes

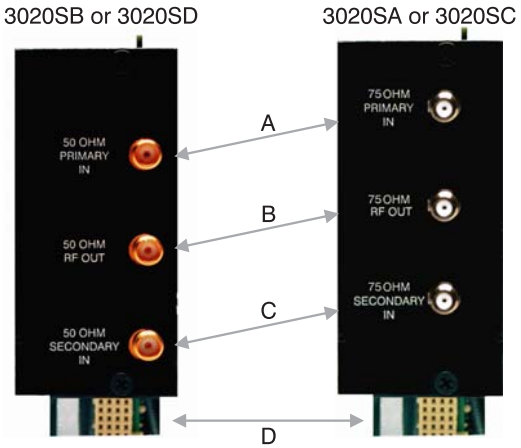
1) The units may be ordered for 75 Ohm or 50 Ohm operation.
2) Unswitched input terminated into 50 Ohms internally.
3) Worst-case isolation occurs above 2 GHz.
4) The Threshold Set Range is the adjustment range of the PRIMARY TRIP POINT which can be read on the corresponding test point on the front panel. This voltage is adjusted using the TRIP POINT ADJUST buttons on the front panel.
5) This product conforms to the Electromagnetic Compatibility Requirements in accordance with European Community Directive #89-336-EEC.
6) The Model 3020 uses the Model 3000 3RU rack chassis and power supplies. See IOM3000C for complete details on rack chassis and power supplies.

Installation and Operation

General Installation Instructions

Installation of the Model 3020 normally requires only verification of signal inputs and outputs. Locate the equipment in an area that provides adequate lighting and is relatively free from dust. **Do not install the equipment near sources of excessive heat, such as furnace outlets or above heat producing units, such as large power supplies and tube-type equipment. Slots and openings in the rear panel are provided for ventilation. To protect from overheating, these openings must not be blocked or covered. Observe temperature and relative humidity requirements specified on page 4.**

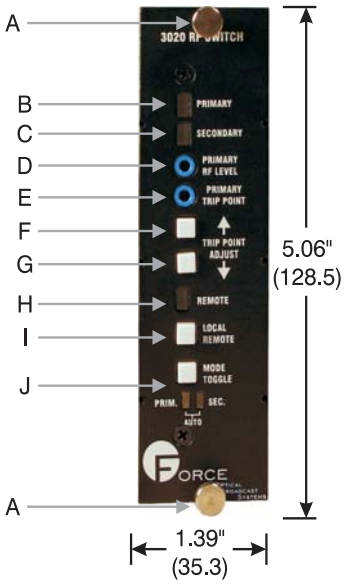
Rear Panel Description



A. 50 (75) OHM PRIMARY IN (50 Ohm SMA connector, 75 Ohm F connector): Primary channel RF Input.
B. 50 (75) OHM RF OUT (50 Ohm SMA connector, 75 Ohm F connector): Common RF Output.
C. 50 (75) OHM SECONDARY IN (50 Ohm SMA connector, 75 Ohm F connector): Secondary channel RF Input.
D. Backplane Connection: Inserts into the backplane of the rack chassis, allowing the chassis to provide power to the module.

Figure 1 Model 3020 RF Switch Rear Panel

Module Front Panel Description



A. Thurmbscrews (2 Places): Used to secure the module top and bottom to the 3RU chassis.
B. Primary LED (Green): When lit, indicates the unit has connected the primary RF input channel to the RF OUT connector.
C. Secondary LED (Green): When lit, indicates the unit has connected the secondary RF input channel to the RF OUT connector.
D. Primary RF Level: This test point allows the current RF input level associated with the primary channel to be monitored.
E. Primary Trip Point: This test point allows the trip voltage associated with the primary channel to be monitored.
F. Trip Point Adjust Up Button: Used to adjust the PRIMARY TRIP POINT voltage up in 20 mV increments. Note: if this button is held down, the voltage will increase about 100 mV per second.
G. Trip Point Adjust Down Button: Used to adjust the PRIMARY TRIP POINT voltage down in 20 mV increments. Note: if this button is held down, the voltage will decrease about 100 mV per second.
H. Remote LED (Red): When lit, indicates the unit is operating in remote mode under SNMP control.
I. Local Remote Button: Push button allows the user to manually switch the unit from local to remote mode.
J. Mode Toggle Button: Used to switch between Secondary, Primary, and Auto modes.

Figure 2 Model 3020 RF Switch Module Front Panel

(Dimensions in parentheses are in millimeters.)

3RU Chassis Description

The Model 3020 occupies one slot in the Model 3000 3RU rack chassis, which can house one or two power supplies, one Model 3020, and up to six hot-swappable transmitter or receiver modules. A DB-25 connector on the rear of the chassis may be used for fault monitoring. (See IOM3000C for complete details.) The following conditions will trigger a summary fault on the chassis DB-25 connector: System Under Temp, System Over Temp, RF Input Low on the primary path.

3RU Power Supply Description

Four power supply modules may be specified. The Model 3000UC-NN power supply provides universal AC power to the units installed in the chassis. The Model 3000UB-NN supplies universal AC power and adds SNMP or web-based system monitoring capability. Model 3000UE-NN provides -48 Volts DC, and the Model 3000UD-NN is the SNMP version, also providing -48 Volts DC. Regardless of the model ordered, one or two power supplies may be accommodated in the 3RU chassis. The power supplies feature a green “Power On” LED that indicates when the chassis is receiving power. A ground point on the front panel provides a common ground for all modules installed in the chassis. The power supplies meet UL requirements. See IOM3000C for specifications and details.

Items Provided

The following is a list of items provided with each Model 3020:

Qty.	Mfr.	P/N	Description
AR	Force, Inc.	3020SX	RF Switch Module
1 per unit	Any	Any	Active Device Receptacle Caps

Items Required

Qty.	Mfr.	P/N	Description
AR	Force, Inc.	3000CB-NN	3RU Rack Chassis
1 or 2 per chassis	Force, Inc.	3000UX-NN	3RU Power Supply Universal AC or -48 Volts DC, SNMP monitoring and control option available.
AR	Force, Inc.	3000EA-NN	Optional Blank Panel for unused module slots
AR	Force, Inc.	3000EB-NN	Optional Blank Panel for unused power supply slot.
1 per AC Power supply	Any	Any	Three-wire Ground IEC Power Cable (AC Versions)
AR	Any	Any	14 AWG Stranded Copper Wire (UL 1061, 300V, 80°C) (DC Versions)
1	Any	Any	Straight Screwdriver
AR	Any	Any	Standard EIA 19" Rack with Earth Ground (rack-mount configuration only)

Inspection

Remove the units from their shipping container. Any in-shipment damage that may have occurred should be visually apparent. Look for bent or damaged connectors or mounting brackets. Claims for damage incurred in shipment should be made directly to the transportation company in accordance with their instructions. Save the shipping cartons until installation and performance verification are completed.

General Module Installation

The modules come pre-installed in the 3000 chassis. Make sure that adequate space is available for cabling and safe access for inspection or troubleshooting. When replacing modules, align the top and bottom of the module with the module guides in the 3RU rack. Push the module firmly to engage the rear power plane connector.

NOTE

When using redundant power supplies, apply power to the power supply before installation into the rack chassis. If power is not at the power supply at installation, an alarm condition will be reported to the DB-25 connector located at the rear of the rack chassis. See IOM3000C for a list of faults that may be reported.

Front Panel Controls

Control Name	Control Type	Function
Primary RF Level	Test Point	Voltage Corresponding to RF Level
Primary Trip Point	Test Point	Voltage Corresponding to Trip Point between Primary and Secondary
Mode Switch	Push Button	See Front Panel Description, Item J
Gain Adjust Up	Push Button	See Front Panel Description, Item H
Gain Adjust Down	Push Button	See Front Panel Description, Item I
Local	Push Button	See Front Panel Description, Item G

Rear Panel Connections

Connector Name	Connector Type	Function
Primary In	SMA (50 Ohm)/F (75 Ohm)	Primary RF Signal In
Secondary In	SMA (50 Ohm)/F (75 Ohm)	Secondary RF Signal In
RF Out	SMA (50 Ohm)/F (75 Ohm)	Common RF Signal Out

LED Functions

Name	Color	Condition
Remote	Red	Unit is operating in remote mode under SNMP control.
Primary	Green	Unit has connected the primary RF input channel to the RF Out connector.
Secondary	Green	Unit has connected the secondary RF input channel to the RF Out connector.

Safety Precautions

The optical emission from the units are laser-based. Class IIIb, and may present eye hazards if improperly used. NEVER USE ANY KIND OF OPTICAL INSTRUMENT TO VIEW THE OPTICAL OUTPUT OF THE UNIT. Complete laser safety procedures may be downloaded at http://www.forceinc.com/techbull/laser-safety-procedures.pdf. As always, be careful when working with optical fibers. Fibers can cause painful injury if they penetrate the skin.

Operation Overview

The Model 3020 is a relatively simple product designed to allow a fully redundant, and thus highly reliable fiber optic L-Band or IF link to be created.

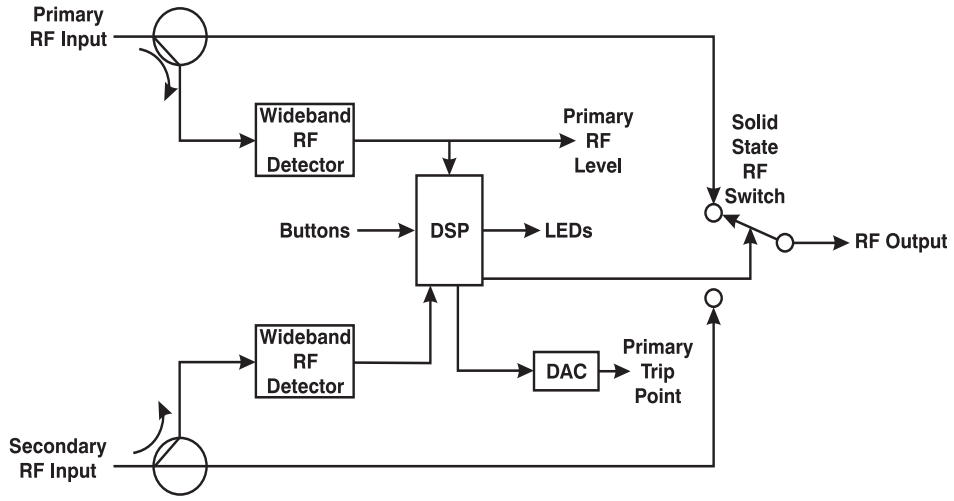


Figure 3 Model 3020 RF Switch Block Diagram

The 3020 operates as follows: First a portion of the primary and secondary RF inputs are split off and fed to wideband RF detectors. The output of the Primary Wideband RF Detector is fed to the DSP and the PRIMARY RF LEVEL test point on the front panel. The output of the Secondary Wideband RF Detector is fed only to the DSP. The DSP considers the input from the Wideband RF Detector(s) along with the current state of the unit and the settings of the various buttons and switches and decides whether the Solid State RF Switch should be configured to output the primary or secondary RF input. The DSP illuminates the various status LEDs to convey the current unit configuration. The DSP sets the analog PRIMARY TRIP POINT via a digital-to-analog converter (DAC).

RF Level Primary Trip Point

In order to properly utilize the 3020 it is important to understand how the RF input levels relate to the DC voltages that can be measured on the PRIMARY RF LEVEL and PRIMARY TRIP POINT on the front panel of the 3020. In order to measure these voltages, connect the ground lead of a digital voltometer (DVM) to the ground terminal on the power supply. Connect the positive lead of the DVM to one of the two test points on the 3020. Figure 4 shows the curve of the average RF input response that can be used to convert from RF Level in dBm to Voltage and vice versa. This figure applies to the PRIMARY RF LEVEL and PRIMARY TRIP POINT. This plot was generated using a single tone at 1500 MHz. The voltage response will vary somewhat across frequency.

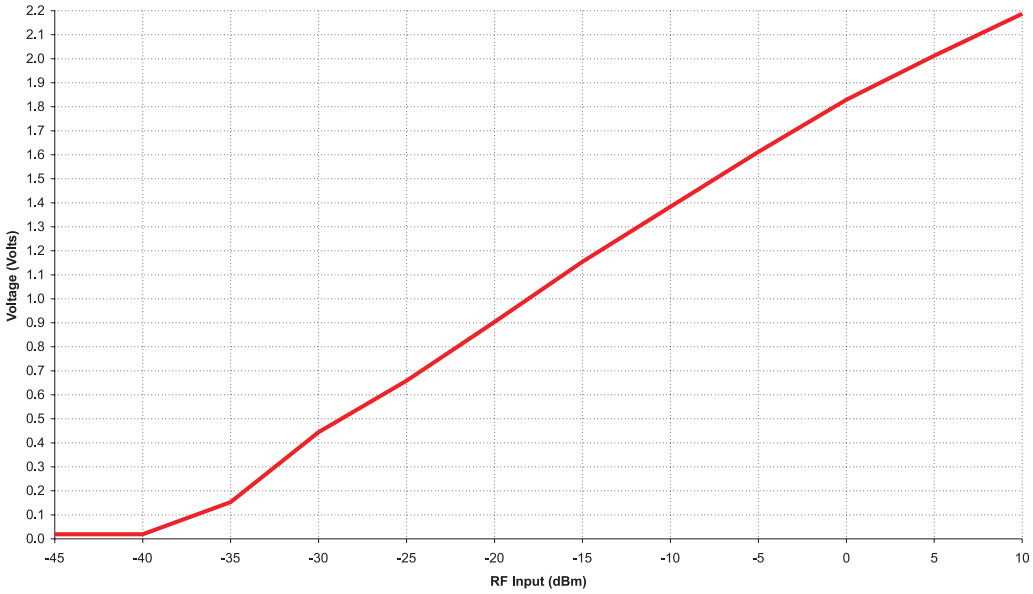


Figure 4 Test Point Voltage vs. RF Input Level

The operation of the 3020 is very straightforward. Use the curve in Figure 4 to determine the trip point threshold. For instance if the desired RF trip point is -20 dBm, then the PRIMARY TRIP POINT voltage should be set to approximately 900 mV using the UP and DOWN buttons. This voltage can be adjusted from 0 mV to about 2,450 mV in 80 mV steps.

The UP and DOWN buttons may also be held down to change the voltage more quickly. If the UP button is held down, the PRIMARY TRIP POINT voltage will increase about 100 mV per second. If the DOWN button is held down, the PRIMARY TRIP POINT voltage will decrease about 100 mV per second.

NOTE

The PRIMARY TRIP POINT voltage is updated to non-volatile memory after no buttons have been pushed on the front panel for 10 seconds. Once non-volatile memory has been updated the PRIMARY TRIP POINT voltage will be held even if the unit is power cycled.

Modes of Operation

There are three operating modes, Secondary, Auto, and Primary. In the Secondary mode, the 3020 is forced to connect the secondary RF input channel to the RF Output. In the Primary mode, the 3020 is forced to connect the primary RF input channel to the RF Output. In the Auto mode, the 3020 will connect the primary RF input channel to the RF Output as long as the PRIMARY RF LEVEL is greater than the PRIMARY TRIP POINT. If the PRIMARY RF LEVEL drops below the PRIMARY TRIP POINT, even for an instant, the 3020 will connect the secondary RF input to the RF Output. This connection will remain until the PRIMARY RF LEVEL is once again greater than the PRIMARY TRIP POINT at which time the 3020 will connect the output to the primary RF input. Figure 5 presents the same information about the operating modes in a State Diagram Format.

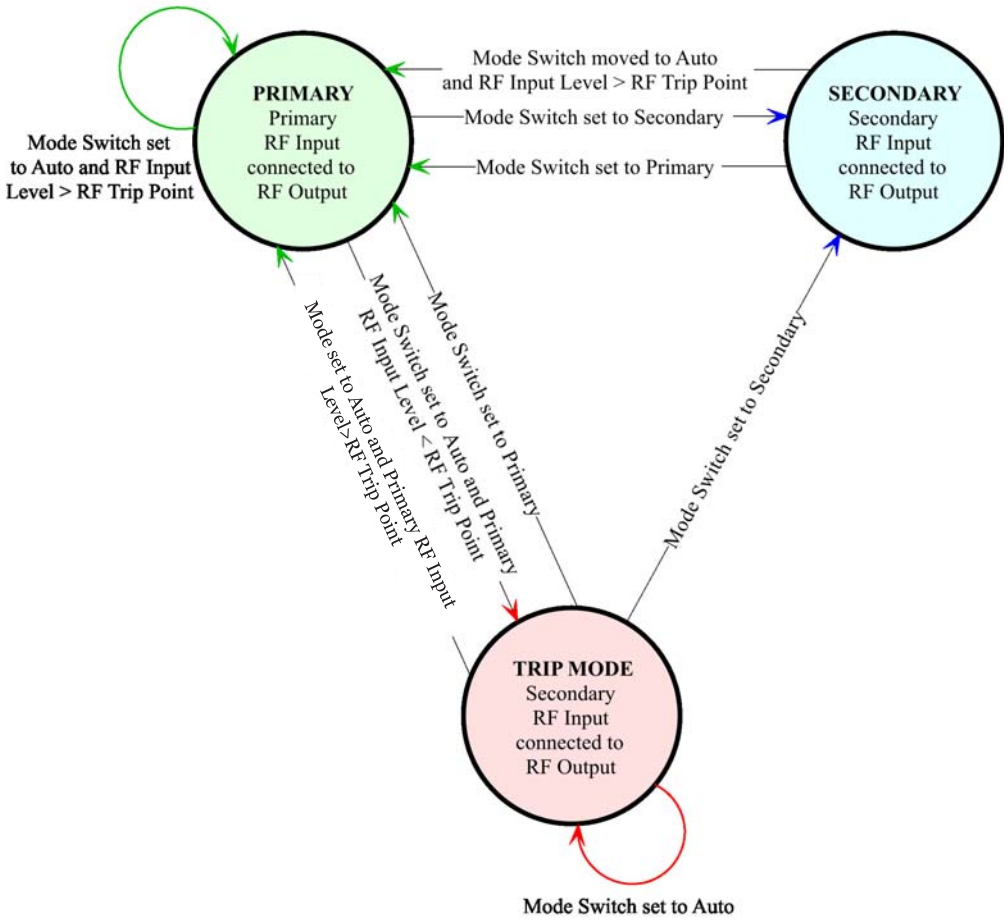


Figure 5 Model 3020 RF Switch State Diagram

SNMP Capabilities

The 3000 series boards are capable of Simple Network Management Protocol (SNMP) monitoring and control over an Internet Protocol (IP) network when used with a SNMP enabled power supply, Model 3000UB-NN or Model 3000UD-NN (refer to IOM3000C for more information) or Model 3001BR-NN Remote SNMP Module (contact the factory for more information). Table 1 lists the common monitoring capabilities of the Model 3020 RF Switch. Table 2 and Table 3 gives information on SNMP monitoring and control specific to the RF Switch.

Table 1 Monitoring Capabilities for the Model 3020

Common	
Serial Number	Lists the serial number of the addressed card.
Uptime Time	Displays the number of seconds the addressed card has been running since power-up.
Model	Displays the model number.
Slot ID	Displays the slot number of the board.
Firmware Version	Lists the firmware version.
Fault Status	System Over Temp
	System Under Temp
	RF Input Low
Local/Remote	Local/Remote Access State
System Board Temperature	Displays the system temperature of the addressed card in degrees Celsius.

Table 2 RF Switch Specific Monitoring Capabilities for the Model 3020

Parameter	Description
Active RF Path	Secondary, Primary
Switch Mode	Secondary, Primary, Auto
RF Level Status	Lists the RF Level status of the addressed card.
	Within Spec
	High
	Low
RF Input Level	Displays the estimated RF input level in dBm.
Trip Level	Trip point in dBm.

Table 3 lists the controlling capabilities of the RF Switch.

Table 3 Control Capabilities of the Model 3020 RF Switch

Parameter	Description
Local/Remote	Change the state (Local or Remote) of the transmitter.
Trip Level	Trip level in dBm
Reset	Initiates a hardware reset on the board.
Switch Mode	Secondary, Primary, Auto

Summary Fault Alarms

Table 4 lists the different conditions that cause the summary fault to trigger. The summary fault is routed to the back plane for rack-mounted systems and routed out of the power connector for stand-alone systems (refer to IOM3000C for detailed information). A fault condition is defined as a normally closed dry contact closure.

Table 4 Summary Fault Alarms

System Over Temp
System Under Temp
RF Input Low

Initial Power-up

1. Locate the chassis and units in the proper environment.
2. Connect the RF inputs to the RF switch.
3. Connect the RF common output to the switch to the appropriate equipment.
4. Connect the companion Teleport equipment and optical transport as required.
5. When all cable connections have been made, apply power to the unit. The green “Power” LED on the power supply front panel should light.
6. Set the Primary Trip Point threshold. The units should be full operational.

Cleaning

If the units need to be cleaned, avoid the user of all solvents and use low-pressure clean air to remove loose dirt. Use low-pressure clean air to clear the connectors of any debris. Dirty or scratched connector end faces will greatly reduce the units performance. Foam-tipped swabs such as the 2.5mm Mini Foam Swab offered by Fiber Instrument Sales (P/N F1-0005) may be saturated with denatured alcohol* and inserted into the optical port for cleaning. DO NOT INSERT A DRY SWAB INTO THE OPTICAL PORT AS THIS MAY DAMAGE THE FIBER END FACE. Many fiber optic installations experience degraded performance due to dirty optical connector end faces. For complete connector cleaning instructions, download http://www.forceinc.com/techbull/optical-connector-cleaning.pdf from Force’s web site.

Troubleshooting

Common problems include lack of power, reversed power (stand-alone units only), or improper input levels. The units are designed to work with a 75 Ohm system or a 50 Ohm system depending on the model ordered. A number of indicator LEDs on the units may assist in troubleshooting. These allow the user to quickly assess the nature of any major unit malfunctions.

Problems and Comments

Problem	Check	Comments
No LEDs are lit on the 3020	Check that the POWER LED on the power supply is lit	While the 3020 does not have a separate power light, either the PRIMARY or SECONDARY LED will always be lit thus serving as a positive indication of power.
	Try removing the 3020 module and reinserting it into the chassis.	Be sure the module is fully inserted.
The unit does not switch over to the SECONDARY channel in the AUTO mode.	Be sure the PRIMARY channel RF input level is at the expected level.	Be sure to measure the total power in dBm, not just the level of a given carrier.
	Be sure that the PRIMARY TRIP LEVEL is set at the correct voltage according to the curve in Figure 4, page 9.	
The unit will not switch back to the PRIMARY channel.	Be sure that the PRIMARY RF LEVEL is greater than the value set for the PRIMARY TRIP POINT.	Once the PRIMARY RF LEVEL is greater than the value set for the PRIMARY TRIP POINT, the unit can be reset by doing one of the three following steps to restore the connection to the primary channel; 1) Power cycle the 3020 2) Switch the mode to PRIMARY and then back to AUTO 3) Switch the mode to SECONDARY and then back to AUTO.
	To force operation on the PRIMARY channel, set the mode switch to PRIMARY.	
The signal level out of the 3020 is less than the input signal.		This is normal. The 3020 typically has a 4 dB insertion loss.

Warranty and Return Policy

Warranty

Force, Incorporated standard products are warranted to be free from defects in materials and workmanship, meeting or exceeding factory specified performance standards for a period of three (3) years from date of purchase.

Force Obligations

Force will, at its discretion and expense, repair any defect in materials or workmanship or replace the product with a new product. Force will, upon receipt of the return, evaluate the product and communicate to the customer the nature of the problem, and determine if the claim falls under warranty coverage.

If during the warranty period, Force is unable to repair the product to the original warranted state within a reasonable time, or if subcomponents of the unit have been obsoleted or discontinued, then Force has the option to provide an equivalent unit.

Exclusions

This warranty does not extend to any product that has been damaged due to acts of God, accident, misuse, abuse, neglect, improper system design or application, improper installation, improper operation or maintenance, or connection to an improper voltage supply.

The Force warranty does not cover fuses, batteries, and lamps. Modifications or alterations of Force products (including but not limited to installation of non-Force equipment or computer programs), except as authorized by Force, will void this warranty. Removal or breaking of the seals on the product will also void the warranty. In addition, cost of repair by unauthorized persons within the warranty period of the product will not be covered by Force, Incorporated. Such repairs will void the warranty.

Force, Incorporated makes no other representation or warranty of any other kind, express or implied, with respect to the goods, whether as to merchantability, fitness for a particular purpose, or any other matter. Force, Incorporated's liability shall not include liability for any special, indirect or consequential damages, or for any damages arising from or attributable to loss of use, loss of data, loss of goodwill, or loss of anticipated or actual revenue or profit, or failure to realize expected savings, even if Force, Incorporated has been advised of the possibility of such damages. This warranty constitutes Force, Incorporated's entire liability and the customer's sole remedy for defects in material and workmanship.

Product Return Policy

Customers will be permitted to return products for credit, repair, or replacement only after receiving authorization from the Customer Service Manager (CSM) and only with a valid Return Material Authorization (RMA) number. The criteria determining whether a product is covered under this policy are described below and RMA numbers will be issued only under these guidelines. For Return Requests that do not comply with the following criteria, the CSM must have approval from the VP Operations, or designee prior to issuing an RMA number.

Products Returned for Credit - Non Distributor

Customers will be allowed to return product for credit only under the following conditions:

- Products are current standard Force products as per the price list.
- Products are in new, unused, and undamaged condition and are in the original packaging.
- Products were originally shipped to the customer requesting Return Authorization.
- Request for return is for a valid reason as determined by Force, Inc.
- Products were shipped to the customer less than 3 months prior to return request.
- Customer receives proper Return Material Authorization prior to returning the product.
- Customer pays return freight and insurance if requested by Force, Inc.

Customers will be issued a credit for the original selling price of the product less a 20% restocking charge after verification that the product meets the criteria as stated above. Payment to customers with no outstanding balance will be made 30 days after requested by customer.

Products Returned for Repair or Replacement

Force's response to a customer product return request will be based upon whether or not the product is still part of Force's standard product offering and whether or not the product is still under warranty. A product will be considered active if it is currently part of Force's standard product offering. Active products are denoted in Force's current price list. Obsolete products are not considered active. A product is considered under warranty in accordance with "Force, Inc. Product Warranty"

Prior to receiving an RMA number, the customer will be asked to discuss the reason for the return with Technical Support to try to resolve the problem. This discussion will be documented to aid with troubleshooting and repair of the product. Any detail the customer can provide will expedite the process once the product is received.

The criteria denoted above will cause any incoming returns to fall into one of the following categories:

A. The product is currently active and is under warranty.
B. The product is currently obsolete, but is still under warranty.
C. The product is active, but out of warranty.
D. The product is obsolete and out of warranty.

Active Product Under Warranty

Force will honor the warranty for these products. As a result, product(s) should be accepted upon return for rework or repair in accordance with Force's warranty policy.

Obsolete Product Under Warranty

Force will honor the warranty for these products. As a result, product(s) should be accepted upon return for rework or repair in accordance with Force's warranty policy.

Active Out of Warranty

Force will accept return of product under this category as long as the sale of the product occurred less than five (5) years prior to the return request. The product serial number should aid in determining the age in cases where information is not in the data base. Rework or repair will be in accordance with Force's warranty policy and will include an evaluation charge, which will be quoted to the customer prior to the return of the product. The evaluation charge is 20% of the current list price of the product or a minimum of $250 whichever is

greater. The customer will either need to provide a purchase order number (with approved credit) or a credit card number before receiving an RMA number. Force cannot guarantee its ability to repair or rework the product. If costs to repair the product exceed the evaluation charge, the customer will be notified of such charges and instruction to proceed with repairs will be indicated either by a P.O. number or credit card authorization.

Obsolete Product Out of Warranty

Force is not obligated to accept requests for product under this category. The CSM, with prior approval from Operations will be responsible for approving return requests for products falling under this category.

Receiving an RMA for Returns

Customers requesting RMA numbers for any reason will be instructed as to how and where to ship the products being returned, and will be directed to show the RMA number on all external packaging and documentation. The CSM is responsible for providing any necessary instructions to the customer to ensure proper handling of the retuned material. Upon receipt of the product, all Force personnel are to process the return as per SP002,"Handling of Customer Returns". Contact the factory at USA (800) 732-5252 or TEL (540) 382-0462 to request an RMA.

Shipping and Handling Precautions

The units are, in general, very rugged and can withstand the stresses of most shipping and handling circumstances. However, the following precautions should be taken:

1) When the units are shipped they should be wrapped in a protective material, such as bubble wrap, to protect against excessive jarring and to prevent damage to the external finish of the units. Always use packing material to separate multiple units that are packaged together.
2) Care should be taken not to drop or strike the units in any way, especially around the optical connectors.
3) The units should never be submersed in any liquid. **SEVERE SHOCK HAZARD!**

Storing the Unit

If a unit is to be out of use for an extended period of time, the following steps should be taken to ensure the preservation of the unit:

1) The storage temperature range is -40°C to +60°C. Allow time for unit to restore to room temperature (and dry out) before power is applied.
2) A low humidity environment is preferable for long term storage.
3) All connectors should be covered with active device receptacle caps.